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(54) **SELECTIVE AUTHENTICATION OF USER DEVICES IN WIRELESS COMMUNICATION NETWORKS**

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(52) **U.S. Cl.**
CPC ***H04W 48/18*** (2013.01)

(58) **Field of Classification Search**
CPC combination set(s) only.
See application file for complete search history.

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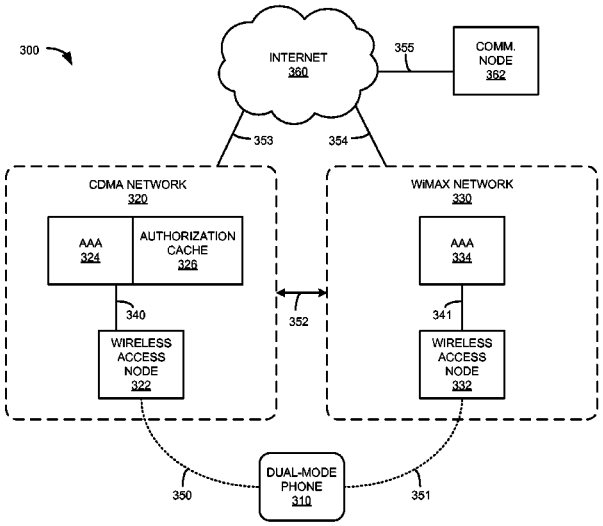
(57) **ABSTRACT**

What is disclosed is a method of operating a communication system, where a user device receives wireless access for a communication session over a first wireless communication network. The method includes receiving a registration request transferred by the user device for wireless access from a second wireless communication network, and in response to the registration request, processing an authentication status for the communication session of the first wireless communication network to authenticate the communication session in the second wireless communication network.

9 Claims, 5 Drawing Sheets



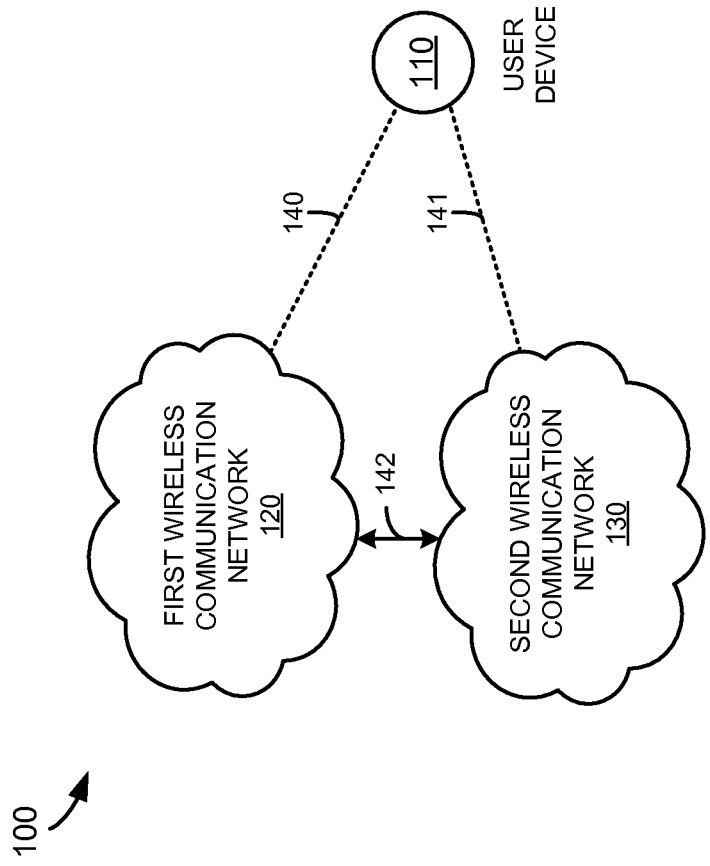

100
FIRST WIRELESS COMMUNICATION NETWORK 120
SECOND WIRELESS COMMUNICATION NETWORK 130
142
140
141
110
USER DEVICE

FIGURE 1

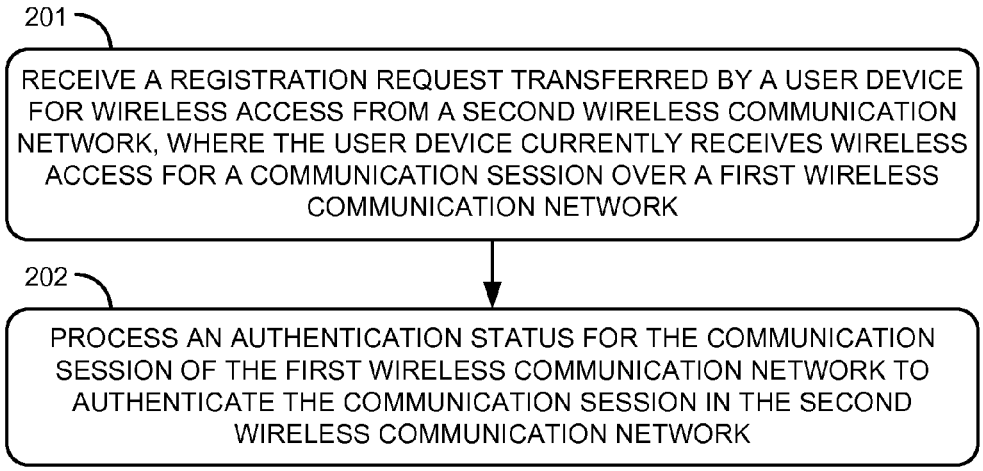

201
RECEIVE A REGISTRATION REQUEST TRANSFERRED BY A USER DEVICE FOR WIRELESS ACCESS FROM A SECOND WIRELESS COMMUNICATION NETWORK, WHERE THE USER DEVICE CURRENTLY RECEIVES WIRELESS ACCESS FOR A COMMUNICATION SESSION OVER A FIRST WIRELESS COMMUNICATION NETWORK
202
PROCESS AN AUTHENTICATION STATUS FOR THE COMMUNICATION SESSION OF THE FIRST WIRELESS COMMUNICATION NETWORK TO AUTHENTICATE THE COMMUNICATION SESSION IN THE SECOND WIRELESS COMMUNICATION NETWORK

FIGURE 2

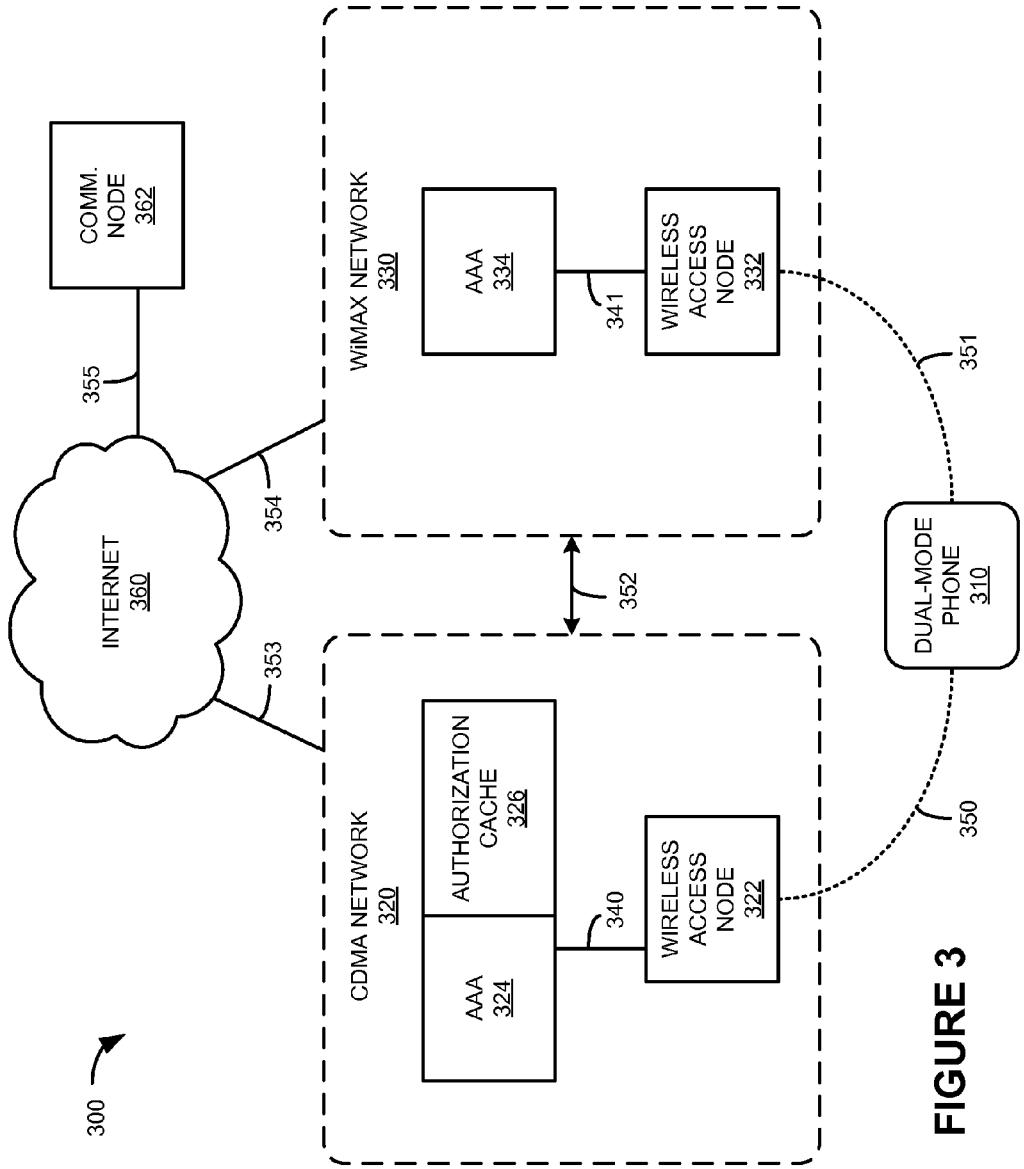

COMM. NODE 362
355
INTERNET 360
354
353
WiMAX NETWORK 330
AAA 334
341
WIRELESS ACCESS NODE 332
351
352
DUAL-MODE PHONE 310
CDMA NETWORK 320
AUTHORIZATION CACHE 326
AAA 324
340
WIRELESS ACCESS NODE 322
350
300

FIGURE 3

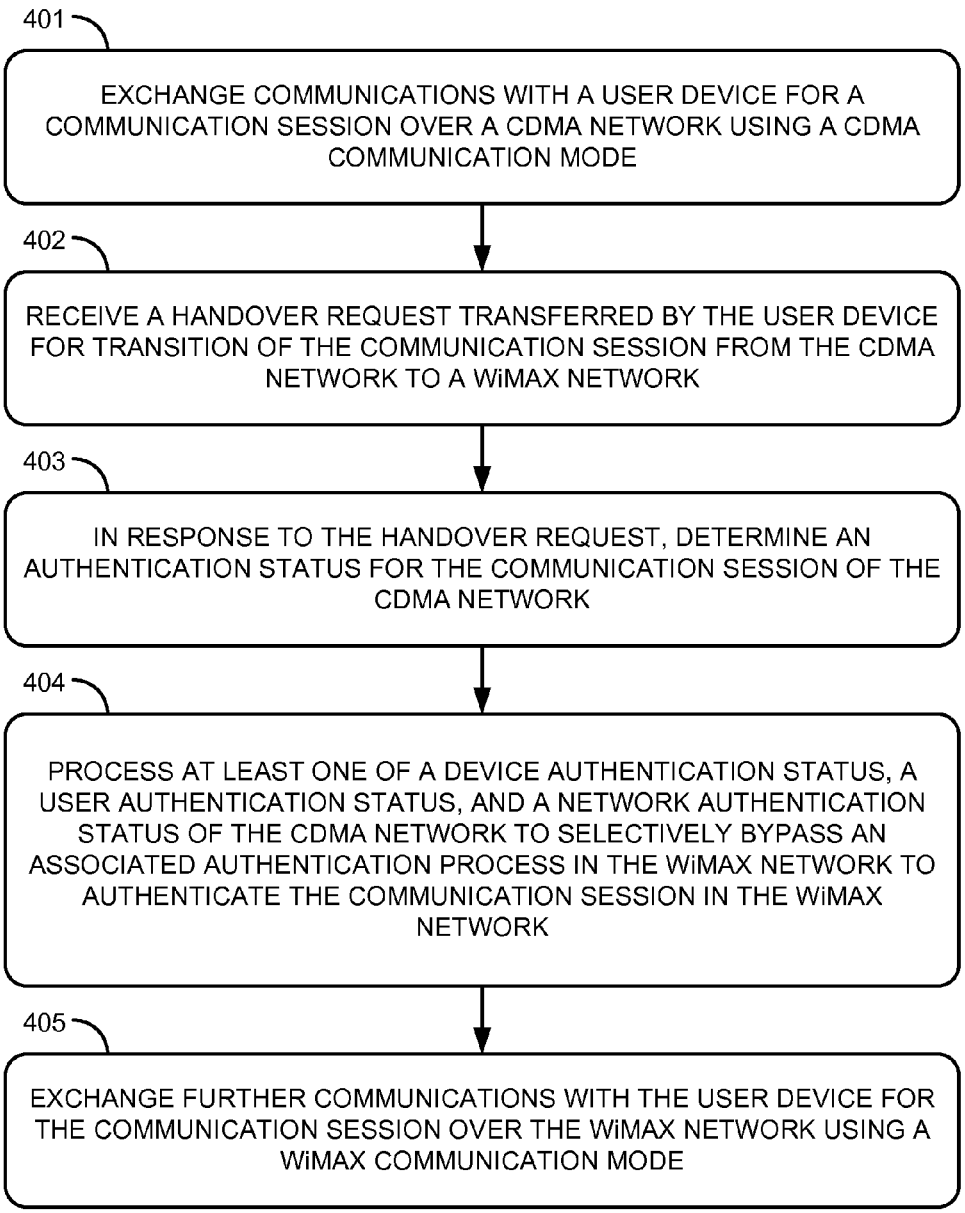

401
EXCHANGE COMMUNICATIONS WITH A USER DEVICE FOR A COMMUNICATION SESSION OVER A CDMA NETWORK USING A CDMA COMMUNICATION MODE
402
RECEIVE A HANDOVER REQUEST TRANSFERRED BY THE USER DEVICE FOR TRANSITION OF THE COMMUNICATION SESSION FROM THE CDMA NETWORK TO A WiMAX NETWORK
403
IN RESPONSE TO THE HANDOVER REQUEST, DETERMINE AN AUTHENTICATION STATUS FOR THE COMMUNICATION SESSION OF THE CDMA NETWORK
404
PROCESS AT LEAST ONE OF A DEVICE AUTHENTICATION STATUS, A USER AUTHENTICATION STATUS, AND A NETWORK AUTHENTICATION STATUS OF THE CDMA NETWORK TO SELECTIVELY BYPASS AN ASSOCIATED AUTHENTICATION PROCESS IN THE WiMAX NETWORK TO AUTHENTICATE THE COMMUNICATION SESSION IN THE WiMAX NETWORK
405
EXCHANGE FURTHER COMMUNICATIONS WITH THE USER DEVICE FOR THE COMMUNICATION SESSION OVER THE WiMAX NETWORK USING A WiMAX COMMUNICATION MODE

FIGURE 4

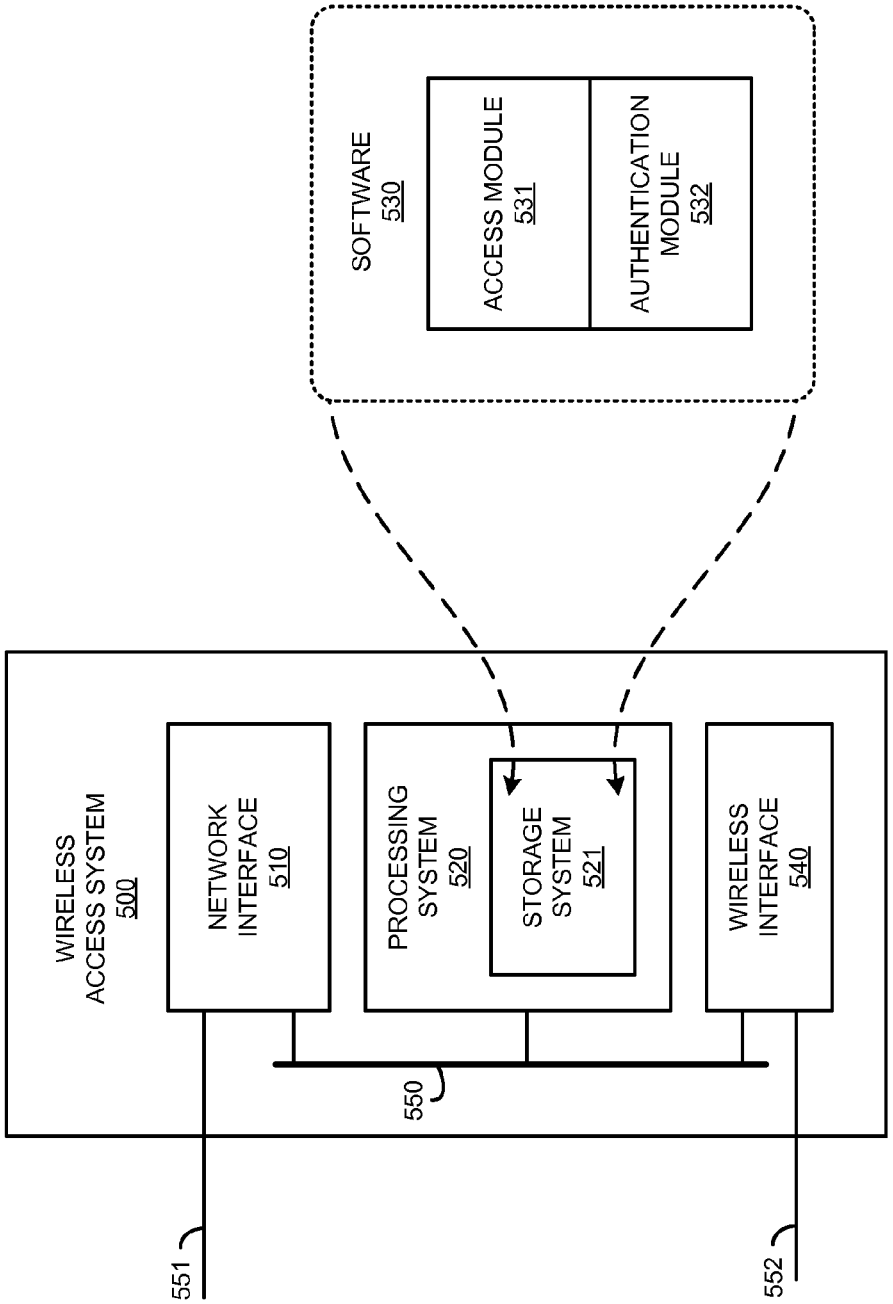

SOFTWARE
530
ACCESS MODULE
531
AUTHENTICATION
MODULE
532
WIRELESS
ACCESS SYSTEM
500
NETWORK
INTERFACE
510
PROCESSING
SYSTEM
520
STORAGE
SYSTEM
521
WIRELESS
INTERFACE
540
550
551
552

FIGURE 5

SELECTIVE AUTHENTICATION OF USER DEVICES IN WIRELESS COMMUNICATION NETWORKS

TECHNICAL FIELD

Aspects of the disclosure are related to the field of communications, and in particular, authenticating user devices in wireless communication networks.

TECHNICAL BACKGROUND

Wireless communication networks typically include access equipment to provide wireless access to communication services for user devices. The access equipment can include base stations, authentication nodes, or other equipment to provide the wireless access. A wireless communication network typically provides coverage for wireless access over a geographic area, such as a metro area. Additionally, multiple wireless communication networks can provide coverage over similar geographic areas, such as the same metro area. The multiple wireless communication networks could each employ different features, communication modes, protocols, or channels.

A user device typically enters into a registration process with access equipment of a wireless communication network when the user device seeks to obtain wireless access from that wireless communication network. However, when the user device transitions to a second wireless communication network, a separate registration process occurs. This can lead to communication delays for the user device during the registration process with the second wireless communication network.

Overview

What is disclosed is a method of operating a communication system, where a user device receives wireless access for a communication session over a first wireless communication network. The method includes receiving a registration request transferred by the user device for wireless access from a second wireless communication network, and in response to the registration request, processing an authentication status for the communication session of the first wireless communication network to authenticate the communication session in the second wireless communication network.

What is also disclosed is a communication system. The communication system includes a first wireless communication network configured to provide wireless access to a user device for a communication session over the first wireless communication network. The communication system also includes a second wireless communication network configured to receive a registration request transferred by the user device for wireless access from the second wireless communication network. In response to the registration request, the second wireless communication network is configured to process an authentication status for the communication session of the first wireless communication network to authenticate the communication session in the second wireless communication network.

What is also disclosed is a method of operating a communication system. The method includes exchanging communications with a user device for a communication session over a first wireless communication network using a first wireless communication mode, and receiving a handover request transferred by the user device for transition of the communication session from the first wireless communication network to a second wireless communication network. In response to the handover request, the method includes determining an authentication status for the communication session of the first wireless communication network, and processing at least a first portion of the authentication status of the first wireless communication network to authenticate the communication session in the second wireless communication network. The method also includes exchanging further communications with the user device for the communication session over the second wireless communication network using a second wireless communication mode.

BRIEF DESCRIPTION OF THE DRAWINGS

Many aspects of the disclosure can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present disclosure. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views. While several embodiments are described in connection with these drawings, the disclosure is not limited to the embodiments disclosed herein. On the contrary, the intent is to cover all alternatives, modifications, and equivalents.

FIG. **1** is a system diagram illustrating a communication system.

FIG. **2** is a flow diagram illustrating a method of operation of a communication system.

FIG. **3** is a system diagram illustrating a communication system.

FIG. **4** is a flow diagram illustrating a method of operation of a communication system.

FIG. **5** is a block diagram illustrating a wireless access node.

DETAILED DESCRIPTION

FIG. **1** is a system diagram illustrating communication system **100**. Communication system **100** includes user device **110**, first wireless communication network **120**, and second wireless communication network **130**. User device **110** and first wireless communication network **120** communicate over wireless link **140**. User device **110** and second wireless communication network **130** communicate over wireless link **141**. First wireless communication network **120** and second wireless communication network **130** are communicatively coupled over link **142**.

In FIG. **1**, both first wireless communication network **120** and second wireless communication network **130** can provide wireless access to communication services for user devices, such as voice calls, text messaging, or Internet access, among other services. Initially, user device **110** is engaged in a communication session through first wireless communication network **120**, and receives wireless access to communication services through first wireless communication network **120** over wireless link **140**. Typically, user device **110** and first wireless communication network **120** enter into a registration or negotiation process to establish the communication session over wireless link **140**. During operation, user device **110** may transition to receive wireless access to the communication services through second wireless communication network **130**, perhaps due to physical movement of user device **110** into a different geographic area, due to user device **110** requesting a different set of services or feature set than first wireless communication network **120** can provide, or initiating another communication session, among other reasons.

FIG. **2** is a flow diagram illustrating a method of operating communication system **100**. The operations of FIG. **2** are referenced herein parenthetically. In FIG. **2**, second wireless

communication network **130** receives (**201**) a registration request transferred by user device **110** for wireless access from second wireless communication network **130**, where user device **110** currently receives wireless access for a communication session over first wireless communication network **120**. As discussed above, to receive wireless access through first wireless communication network **120**, user device **110** went through a registration process with first wireless communication network **120**, which could include authentication, authorization, or other processes to enable user device **110** to establish a communication session through first wireless communication network **120**. A similar registration process could begin between user device **110** and second wireless communication network **130** in response to the registration request received in second wireless communication network **130**.

Second wireless communication network **130** processes (**202**) an authentication status for the communication session of first wireless communication network **120** to authenticate the communication session in second wireless communication network **130**. In some examples, responsive to the registration request, second wireless communication network **130** requests the authentication status from first wireless communication network **120**. In other examples, the authentication status is pushed to second wireless communication network **130** by first wireless communication network responsive to user device **110** transitioning from wireless access through first wireless communication network **120** to second wireless communication network **130**. The authentication status could include device authentication information, user authentication information, or network authentication information, among other authentication or authorization information for user device **110**. The authentication status for the communication session between first wireless communication network **120** and user device **110** could be stored within equipment or systems of first wireless communication system **120**. In this example, the authentication status is exchanged between first wireless communication network **120** and second wireless communication network **130** over link **142**.

FIG. **3** is a system diagram illustrating communication system **300**. Communication system **300** includes dual-mode phone **310**, Code Division Multiple Access (CDMA) network **320**, Worldwide Interoperability for Microwave Access (WiMAX) network **330**, Internet **360**, and communication node **362**. Phone **310** and CDMA network **320** can communicate over wireless link **350**, which is a CDMA wireless link in this example. Phone **310** and WiMAX network **330** can communicate over link **351**, which is a WiMAX wireless link in this example. CDMA network **320** and WiMAX network **330** communicate over link **352**, which is a metropolitan area networking link capable of carrying packet communications. CDMA network **320** and Internet **360** communicate over link **353**, which is an optical networking link capable of carrying Internet protocol (IP) traffic. WiMAX network **330** and Internet **360** communicate over link **354**, which is an optical networking link capable of carrying Internet protocol (IP) traffic. Internet **360** and communication node **362** communicate over IP link **355**.

Dual-mode phone **310** is a user device, comprising a wireless mobile phone in this example, and is capable of communicating in at least two different wireless communication modes, namely the CDMA and WiMAX communication modes. In this example, wireless link **350** and wireless link **351** employ different wireless communication modes or wireless communication protocols. It should be understood that other wireless protocols or wireless access network technologies could be employed. It should also be understood that in this example, dual-mode phone **310** represents a user device that can provide voice and/or data services over wireless links.

CDMA network **320** is a wireless network of a wireless communication provider, such as a wireless phone and data service provider. CDMA network **320** includes wireless access node **322**, authentication, authorization and accounting (AAA) system **324**, and authorization cache **326**. Wireless access node **322** includes equipment and systems to provide wireless access to communication services for user devices within a coverage area. Wireless access node **322** could comprise a base station or a base transceiver stations (BTS), and could include transceiver and antenna circuitry. Wireless access node **322** and AAA **324** communicate over link **340**, which is an Ethernet link in this example. It should be understood that other communication equipment could be communicatively positioned between wireless access node **322** and AAA **324**, such as routers, base station controllers (BSC), mobile switching centers (MSC), radio network controllers (RNC), or other communication equipment.

AAA **324** includes computer processing equipment for authenticating and authorizing user devices for various wireless access features of CDMA network **320**, as well as equipment to determine accounting information for user devices, such as billing, metering, time-based usage, or other user device account monitoring information. AAA **324** also includes equipment to store and retrieve authentication status information in authorization cache **326**. Authorization cache **326** includes equipment such as processing systems, communication interfaces, computer-readable storage media, and other equipment to store and transfer authentication status information for user devices. In some examples, authorization cache **326** is located within the same equipment as AAA **324**, wireless access node **322**, or other equipment of CDMA network **320**. Authorization cache **326** includes a computer-readable medium such as a disk, tape, integrated circuit, server, or some other memory device, and also may be distributed among multiple memory devices. Authorization cache **326** may comprise an operating system, logs, utilities, drivers, networking software, firmware, and other software typically loaded onto a computer system. It should be understood that the authentication status information could be referred to as authorization status information in some examples.

Although not shown in FIG. **3** for clarity, CDMA network **320** could also include further wireless access nodes, radio network controllers (RNC), base station controllers (BSC), mobile switching centers (MSC), home location registers (HLR), packet data switching nodes (PDSN), home agents (HA), mobility access gateways (MAG), Internet access nodes, call processing systems, telephony service nodes, wireless data access points, routers, databases, or other communication and control equipment.

WiMAX network **330** is also a wireless network of a wireless communication provider, such as a wireless phone and data service provider. WiMAX network **330** could be a wireless network of the same or of a different wireless phone and data service provider than CDMA network **320**. WiMAX network **330** includes wireless access node **332** and authentication, authorization and accounting (AAA) system **334**. Wireless access node **332** and AAA **334** communicate over Ethernet link **341** in this example. It should be understood that other communication equipment could be communicatively positioned between wireless access node **332** and AAA **334**, such as routers, wireless access node controllers, or other communication equipment.

AAA **334** includes computer processing equipment for authenticating and authorizing user devices for various wireless access features of WiMAX network **330**, as well as equipment to determine accounting information for user devices, such as billing, metering, time-based usage, or other user device account monitoring information. In further examples, WiMAX network **330** also includes an authorization cache as found in CDMA network **320**. In typical examples, AAA **334** retrieves dual-mode phone **310** authentication status data from authorization cache **326** and transfers the authentication status data for storage in elements of WiMAX network **330**, such as a WiMAX authorization cache.

Although not shown in FIG. **3** for clarity, WiMAX network **330** could also include further wireless access nodes, wireless access node controllers, mobile switching centers (MSC), access service network gateways (ASN-GW), home agents (HA), mobility access gateways (MAG), Internet access nodes, call processing systems, telephony service nodes, wireless data access points, routers, databases, authorization caches, or other communication and control equipment.

Internet **360** includes equipment and systems to route packet communications between endpoints using the Internet protocol (IP). Internet **360** could comprise routers, switches, gateways, bridges, as well as various network links. Communication node **362** exemplifies a communication endpoint for phone **310** to communicate with, such as an endpoint node for a communication session. Communication node **362** communicates over Internet **360** and link **355** with other communication nodes, such as user devices. Examples of communication node **362** include video servers, media storage systems, data servers, computers, processing systems, storage-area networks, web servers, application servers, network-attached storage systems, or other equipment, including combinations thereof. In further examples, communication node **362** comprises a user device, such as discussed herein for phone **310** or user device **110**.

FIG. **4** is a flow diagram illustrating a method of operating communication system **300**. The operations of FIG. **4** are referenced herein parenthetically. In FIG. **4**, CDMA network **320** exchanges (**401**) communications with phone **310** for a communication session over CDMA network **320** using a CDMA communication mode. In FIG. **3**, CDMA network **320** can provide wireless access to communication services for user devices, such as voice calls, text messaging, or Internet access, among other services. Initially, phone **310** is engaged in a communication session through CDMA network **320**, and receives wireless access to communication services through CDMA network **320** over wireless link **350**. In this example, phone **310** and communication node **362** are engaged in the communication session over CDMA network **320** and Internet **360**. The communication session could comprise an IP application session, such as a video stream, voice call, video conference, data transfer, web site access, virtual private network (VPN) access, or other IP application session.

Typically, phone **310** and CDMA network **320** first enter into a registration or negotiation process to establish the communication session over wireless link **350**. As a part of the registration process between phone **310** and CDMA network **320**, AAA **324** performs various levels of authentication or authorization. The various authentication levels could include device authentication, user authentication, and network authentication, among other authentication and authorization processes. Device authentication includes authorizing the physical equipment of phone **310** itself, such as authenticating a device identity, device type, device identification number, device network access identifier (device NAI), electronic serial number (ESN), International Mobile Subscriber Identity (IMSI), subscriber identity module (SIM), phone number, hardware code, or other identifier associated with a device, such as with phone **310**. User authentication includes authorizing the user of phone **310**, such as authenticating a user identity, checking billing records or accounting information, authenticating personal identifiers, user network access identifier (user NAI), passwords, biometrics, or other information to ensure the user of phone **310** is authorized to access CDMA network **320** through phone **310**. Network authentication includes determining if phone **310** or a user can access network routing features of CDMA network **320**, such as obtaining a network or IP address, gaining access through a network gateway or home agent (HA) of CDMA network **320** to Internet **360**, among other network features. In this example, the network authentication comprises an IP authentication status.

In FIG. **3**, similar to CDMA network **320**, WiMAX network **330** can also provide wireless access to communication services for user devices, such as voice calls, text messaging, or Internet access, among other services. As discussed above, phone **310** is initially engaged in a communication session with communication node **362** through CDMA network **320**, and receives wireless access to communication services through CDMA network **320** over wireless link **350**. During the communication session, phone **310** transitions to receive wireless access through WiMAX network **330** instead of CDMA network **320**, perhaps due to physical movement of phone **310** into a different geographic area, due to phone **310** requesting a different set of services or feature set than CDMA network **320** can provide, due to wireless coverage limitations of CDMA network **320**, or due to phone **310** initiating another communication session, among other reasons. As with CDMA network **320**, phone **310** and WiMAX network **330** typically enter into a registration or negotiation process to establish wireless access over wireless link **351**.

WiMAX network **330** receives (**402**) a handover request transferred by phone **310** for transition of the communication session from CDMA network **320** to WiMAX network **330**. The handover request could comprise a network access request triggered from a handover from CDMA network **320**, such as a request to handoff from wireless access node **322** to wireless access node **332**. In some examples, the handover request is transferred by phone **310** over wireless link **350** to CDMA network **320**, while in other examples, the handover request is transferred by phone **310** over wireless link **351** to WiMAX network **330**. In further examples, CDMA network **320** transfers the handover request to WiMAX network **330** over link **352**. In yet further examples, the handover request could be generated by CDMA network **320** due to activity of phone **310**, such as movement through wireless coverage areas, phone **310** requesting communication services not offered by CDMA network **320**, or due to congestion of CDMA network **320** prompting CDMA network **320** to desire to transition phone **310** to another wireless communication network. Other examples of handover requests or handover notices could be employed. In some examples, the handover request or handover notice includes identifying information for phone **310**, such as phone number, session keys, NAI, ESN, or IMSI, application session identifier, or an IP address for the present communication session, among other identifiers for WiMAX network **330** to identify phone **310** when requesting information from CDMA network **320**. In other examples, the handover request or handover notice includes information about CDMA network **320**, such as technology employed over CDMA network **320**.

In response to the handover request, WiMAX network **330** determines (**403**) an authentication status for the communication session of CDMA network **320**. CDMA network **320** stores authentication status information for phone **310** in authorization cache **326** in this example. Authorization cache **326** could comprise a database containing present authorization states for various user devices communicating with CDMA network **320**. Requests for an authentication status for a particular user device, such as phone **310**, could be received over link **352** into CDMA network **320**, and processed by AAA **324** or authorization cache **326** to determine responses to the requests. WiMAX network **330** could request all information from CDMA network **320** regarding the authentication status of phone **310**, or could request only portions thereof. CDMA network **320** then transfers the requested authentication status for delivery to WiMAX network **330**. Although in this example, link **352** is shown directly between CDMA network **320** and WiMAX network **330**, it should be understood that link **352** could be a logical or virtual link, and communications thereon could be transported over links **353-354** and Internet **360**, among other examples. Link **352** could employ the Extensible Authentication Protocol (EAP). The authentication status could include a tabular data format indicating the status of the various levels of authentication for phone **310**, such as physical device authentication status, user authentication status, or network authentication status, among other status information and formats.

Similar to CDMA network **320**, as a part of the registration process between phone **310** and WiMAX network **330**, AAA **334** performs various levels of authentication or authorization. The various authentication levels could include device authentication, user authentication, and network authentication, among other authentication and authorization processes. However, WiMAX network **330** processes (**404**) at least one of a device authentication status, a user authentication status, and a network authentication status of CDMA network **320** to selectively bypass an associated authentication process in WiMAX network **330** to authenticate the communication session in WiMAX network **330**. The particular authentication status which is bypassed could be selected based upon various factors. In some examples, these factors include a traffic level, congestion level, or processor utilization level of authorization equipment of WiMAX network **330**, such as of AAA **334**. In other examples, these factors include a communication session type or application type of the present communication session between phone **310** and communication node **362**. In further examples, these factors include a technology type, such as a wireless communication mode type or wireless communication protocol type, of CDMA network **320** or wireless link **350**. In yet further examples, these factors include a user payment history, such as on what level a user of phone **310** complied with a monthly bill payment in a past time period, such as a month or a calendar year. The payment history could be determined from tabular data of the authentication status or from another source, such as a billing status received from a billing or accounting system. Registration communications between phone **310** and WiMAX network **330** could be omitted, ignored, or immediately replied to without authentication by WiMAX network **330** during the selective bypass process.

During heavy traffic periods, delays may be incurred by proceeding through a complete authentication and authorization process for phone **310** in WiMAX network **330**. This can lead to communication delays for the communication sessions of phone **310**, latencies in the transfer of communications between communication node **362** and phone **310**, or to increased loading on the authentication and authorization systems of WiMAX network **330**, among other delays and latencies. In some examples, WiMAX network **330** processes an activity level of authorization equipment, such as AAA **334**, of WiMAX network **330** to determine which associated authentication process in WiMAX network **330** is to be bypassed. The activity level of the authorization equipment could comprise a registration drop rate, a registration incomplete rate, and a processor utilization level or the authorization equipment, among other activity levels. Registration drop rates include communication sessions of user devices which are dropped or unexpectedly terminated, registration incomplete rates typically include when a registration process does not complete for user devices, and a processor utilization level typically includes a number of busy cycles of a central processing unit (CPU) of authorization equipment. Other activity levels could be considered, such as an amount of user devices receiving wireless access through WiMAX network **330**, a utilization level of wireless access node **332**, or other activity levels.

In some examples, different levels of activity of the authorization equipment of WiMAX network **330** could correspond to different bypassed authentication levels. For example, a physical device authentication could be bypassed at a first activity level of AAA **334**, physical device authentication and user authentication could be bypassed at a second activity level of AAA **334**, and physical device authentication, user authentication, and IP authentication could be bypassed at a third activity level of AAA **334**. Other examples corresponding different activity levels to authentication bypasses could be employed. The various activity levels could be represented by different thresholds.

In other examples, the technology employed by CDMA network **320** is processed to determine which authentication level to bypass. For example, if the wireless technology employed by CDMA network **320** is different than WiMAX network **330**, then certain authentication levels could be bypassed. As a further example, an IP authentication process could be bypassed in WiMAX network **330**, while still authenticating the physical device and the user in WiMAX network **330**. Other variations on selective authentication based on the different technologies employed by in CDMA network **320** and WiMAX network **330** could be used.

In further examples, such as when the network authentication status comprises an IP authentication status, the authorization equipment of WiMAX network **330** comprises AAA **334** for the device authentication status and the user authentication status, and home agent (HA) equipment for the IP authentication status. IP authentication status or the present IP address associated with the present communication session could be transferred to the HA from CDMA network **320**, while other authentication information could be transferred to AAA **334**. In yet further examples, in response to WiMAX network **330** receiving the authentication status, or authenticating the communication session in WiMAX network **330**, CDMA network **320** could clear the cached authentication status in authorization cache **326** for the communication session. WiMAX network **330** could transfer an acknowledge message to CDMA network **320** to indicate that the authentication status for phone **310** was received, or that phone **310** was authenticated properly in WiMAX network **330**.

WiMAX network **330** exchanges (**405**) further communications with phone **310** for the communication session over WiMAX network **330** using the WiMAX communication mode. In this example, phone **310** and wireless access node **332** communicate over wireless link **351**. In some examples,

WiMAX network **330** maintains the same communication session between phone **310** and communication node **362** for the further communications. Maintaining the same communications session could include maintaining a common IP address for phone **310** throughout the transition from CDMA network **320** to WiMAX network **330** and from wireless link **350** to wireless link **351**. Maintaining the same communications session could also include maintaining other features of the communication session, such as an application session with communication node **362**, or maintaining common billing or metering information and timers. In other examples, a new communication session is initiated, and the communication session between phone **310** and communication node **362** is not maintained.

Although the example presented in FIG. **4** discusses a transition of phone **310** from CDMA network **320** to WiMAX network **330**, it should be understood that similar principles apply to transitions of user devices from WiMAX network **330** to CDMA network **320**. Also, it should be understood that other wireless technologies, protocols, and modes could be employed, as discussed herein for wireless links **140-141** and wireless links **350-351**.

FIG. **5** is a block diagram illustrating wireless access system **500**, as an example of first wireless communication network **120** or second wireless communication network **130** found in FIG. **1**, or CDMA network **320** or WiMAX network **330** found in FIG. **3**, although wireless first wireless communication network **120**, second wireless communication network **130**, CDMA network **320**, or WiMAX network **330** could use other configurations. Wireless access system **500** includes network interface **510**, processing system **520**, and wireless interface **540**. Network interface **510**, processing system **520**, and wireless interface **540** are shown to communicate over a common bus **550** for illustrative purposes. It should be understood that discrete links could be employed, such as network links. Wireless access system **500** may be distributed among multiple devices that together form elements **510**, **520-521**, **530-532**, **540**, and **550-552**.

Network interface **510** comprises network router and gateway equipment for communicating with wireless communication provider equipment, such as with a wireless communication networks, or with core networks, the Internet, or other communication systems. Network interface **510** exchanges user communications and overhead communications over link **551**. Link **551** could use various protocols or communication formats as described herein for links **142**, **340-341**, or **352-355**, including combinations, variations, or improvements thereof.

Processing system **520** includes storage system **521**. Processing system **520** retrieves and executes software **530** from storage system **521**. In some examples, processing system **520** is located within the same equipment in which network interface **510** or wireless interface **540** are located. In further examples, processing system **520** comprises specialized circuitry, and software **530** or storage system **521** could be included in the specialized circuitry to operate processing system **520** as described herein. Storage system **521** could include a computer-readable medium such as a disk, tape, integrated circuit, server, or some other memory device, and also may be distributed among multiple memory devices.

Software **530** may include an operating system, logs, utilities, drivers, networking software, and other software typically loaded onto a computer system. Software **530** could contain application programs, server software, firmware, or some other form of computer-readable processing instructions. When executed by processing system **520**, software **530** directs processing system **520** to operate as described herein, such as receive registration requests, establish wireless links with user devices, authenticate or authorize user devices, communication sessions, or users, and instruct wireless interface **540** to exchange wireless communications with wireless communication devices, among other operations.

In this example, software **530** includes access module **531** and authentication module **532**. It should be understood that a different configuration could be employed, and individual modules of software **530** could be included in different equipment than wireless access system **500**. Access module **531** receives registration requests transferred by user devices seeking wireless access to communication services for communication sessions. Access module **531** communicates with authentication module **532** to authorize or authenticate user devices, users, or communication sessions. Once authorized or authenticated, access module **531** provides wireless access to communication services for the associated user devices. Access module **531** could control the operations of wireless interface **540** for providing the wireless access. Authentication module **532** authenticates and/or authorizes user devices, users, and communication sessions, among others, for access to communication services through wireless access system **500**. Authentication module **532** can exchange authentication and authorization information with other wireless access systems, wireless communication networks, or other entities associated therewith.

Wireless interface **540** comprises communication interfaces for communicating with wireless communication devices, such as user devices. Wireless interface **540** could include transceiver equipment and antenna elements for wirelessly exchanging user communications and overhead communications with user devices, omitted for clarity, over the associated wireless link **552**. Wireless interface **540** also receives command and control information and instructions from processing system **520** or network interface **510** for controlling the operations of user devices over wireless link **552**, coordinating handoffs of user devices between base stations or other wireless access systems, exchanging authentication or authorization information with other wireless communication networks, and transferring communications for delivery to user devices. Wireless link **552** could use various protocols or communication formats as described herein for wireless links **140-141** or **350-351**, including combinations, variations, or improvements thereof.

Bus **550** comprises a physical, logical, or virtual communication link, capable of communicating data, control signals, and communications, along with other information. In some examples, bus **550** is encapsulated within the elements of network interface **510**, processing system **520**, or wireless interface **540**, and may be a software or logical link. In other examples, bus **550** uses various communication media, such as air, space, metal, optical fiber, or some other signal propagation path, including combinations thereof. Bus **550** could be a direct link or might include various equipment, intermediate components, systems, and networks. Bus **550** could be a common link, shared link, or may be comprised of discrete, separate links.

Referring back to FIG. **1**, user device **110** comprises transceiver circuitry and communication elements. The transceiver circuitry typically includes amplifiers, filters, modulators, and signal processing circuitry. User device **110** may also include user interface systems, memory devices, computer-readable storage mediums, software, processing circuitry, or some other communication components. User device **110** may be a wireless communication device, subscriber equipment, customer equipment, access terminal, telephone, mobile wireless telephone, personal digital assis-

tant (PDA), computer, e-book, mobile Internet appliance, wireless network interface card, media player, game console, or some other wireless communication apparatus, including combinations thereof. Although one user devices is shown in FIG. **1**, it should be understood that a different number of user devices could be shown. User device **110** could include multiple transceiver portions or antenna portions, among other circuit and equipment elements, for communicating wirelessly with multiple wireless communication networks, using different wireless communication modes or wireless communication protocols. For example, user device **110** could be a dual-mode phone capable of communicating with first wireless communication network **120** and second wireless communication network **130**.

First wireless communication network **120** comprises communication and control systems for providing access to communication services for user devices. In some examples, first wireless communication network **120** includes equipment to provide wireless access to communication services within different coverage areas to user devices, route communications between content providers and user devices, and receive registration and content requests, among other operations. First wireless communication network **120** may also comprise base stations, base transceiver stations (BTS), base station controllers (BSC), mobile switching centers (MSC), home location registers (HLR), radio node controllers (RNC), call processing systems, authentication, authorization and accounting (AAA) equipment, access service network gateways (ASN-GW), packet data switching nodes (PDSN), home agents (HA), mobility access gateways (MAG), Internet access nodes, telephony service nodes, wireless data access points, routers, databases, or other communication and control equipment.

Second wireless communication network **130** comprises communication and control systems for providing access to communication services for user devices. In some examples, second wireless communication network **130** includes equipment to provide wireless access to communication services within different coverage areas to user devices, route communications between content providers and user devices, and receive registration and content requests, among other operations. Second wireless communication network **130** may also comprise base stations, base transceiver stations (BTS), base station controllers (BSC), mobile switching centers (MSC), home location registers (HLR), radio node controllers (RNC), call processing systems, authentication, authorization and accounting (AAA) equipment, access service network gateways (ASN-GW), packet data switching nodes (PDSN), home agents (HA), mobility access gateways (MAG), Internet access nodes, telephony service nodes, wireless data access points, routers, databases, or other communication and control equipment.

Communication link **142** uses metal, glass, optical, air, space, or some other material as the transport media. Communication link **142** could use various communication protocols, such as Time Division Multiplex (TDM), asynchronous transfer mode (ATM), Internet Protocol (IP), Ethernet, synchronous optical networking (SONET), circuit-switched, communication signaling, wireless communications, or some other communication format, including combinations, improvements, or variations thereof. Communication link **142** could be a direct link or may include intermediate networks, systems, or devices, and could include a logical network link transported over multiple physical links.

Wireless links **140-141** each use the air or space as the transport media. Wireless links **140-141** may each use various protocols, such as Code Division Multiple Access (CDMA), Evolution-Data Optimized (EV-DO), single-carrier radio transmission technology link (1xRTT), Worldwide Interoperability for Microwave Access (WiMAX), Global System for Mobile Communication (GSM), Universal Mobile Telecommunications System (UMTS), Long Term Evolution (LTE), Wireless Fidelity (Wi-Fi), High Speed Packet Access (HSPA), Radio Link Protocol (RLP), or some other wireless communication format, including combinations, improvements, or variations thereof. Although two main wireless links **140-141** are shown in FIG. **1**, it should be understood that wireless links **140-141** are merely illustrative to show communication modes or wireless access pathway for user device **110**. In other examples, further wireless links could be shown, with portions of the further wireless links shared and used for different communication sessions and associated paging or overhead communications.

Communication links **140-142** may each include many different signals sharing the same associated link, as represented by the associated lines in FIG. **1**, comprising access channels, paging channels, notification channels, forward links, reverse links, user communications, communication sessions, overhead communications, frequencies, other channels, carriers, timeslots, spreading codes, transportation ports, logical transportation links, network sockets, packets, or communication directions.

FIGS. **1-5** and the previous descriptions depict specific embodiments to teach those skilled in the art how to make and use the best mode. For the purpose of teaching inventive principles, some conventional aspects have been simplified or omitted. Those skilled in the art will appreciate variations from these embodiments that fall within the scope of the invention. Those skilled in the art will also appreciate that the features described above can be combined in various ways to form multiple embodiments. As a result, the invention is not limited to the specific embodiments described above, but only by the claims and their equivalents.

What is claimed is:

1. A method of operating a communication system, the method comprising:

receiving wireless access for a communication session over a Code Division Multiple Access (CDMA) wireless communication network;

receiving a registration request transferred by a user device for wireless access from another wireless communication network, different from the CDMA wireless communication network;

receiving authentication information for the communication session from Authentication, Authorization, and Accounting (AAA) equipment in the CDMA wireless communication network over the CDMA wireless communication network; wherein the authentication information comprises at least one of user device authentication information, user authentication information, or network authentication information;

in response to the registration request, processing the authentication information for the communication session over the CDMA wireless communication network to selectively bypass an associated authentication process in the other wireless communication network to authenticate the communication session in the other wireless communication network, wherein the other wireless communication network comprises one of: a Long Term Evolution (LTE) wireless communication network or a Worldwide Interoperability for Microwave Access (WiMAX) wireless communication network;

processing an activity level of AAA equipment in the other wireless communication network to select the associ-

ated authentication process in the other wireless communication network to bypass, wherein the activity level of the AAA equipment in the other wireless communication network comprises at least one of a registration drop rate, a registration incomplete rate, and a processor utilization level.

2. The method of claim **1**, wherein the network authentication information comprises Internet protocol (IP) authentication information; and

wherein the AAA equipment in the other wireless communication network comprises home agent (HA) equipment.

3. The method of claim **1**, wherein processing the authentication information for the communication session over the CDMA wireless communication network comprises checking an authorization cache of the CDMA wireless communication network.

4. The method of claim **3**, further comprising:

in response to successfully authenticating the communication session in the other wireless communication network, clearing the authorization cache of the CDMA wireless communication network.

5. The method of claim **1**, further comprising:

exchanging communications with the user device for the communication session over the CDMA wireless communication network using a CDMA wireless communication mode; and

exchanging further communications with the user device for the communication session over the other wireless communication network using another wireless communication mode.

6. The method of claim **5**, wherein exchanging further communications with the user device for the communication session over the other wireless communication network using the other wireless communication mode comprises maintaining the same communication session for the communications over the CDMA wireless communication network and the further communications over the other wireless communication network.

7. The method of claim **5**, wherein the user device comprises a multi-mode wireless communication device, wherein a first mode of the multi-mode wireless communication device comprises the CDMA wireless communication mode, and wherein a second mode of the multi-mode wireless communication device comprises the other wireless communication mode.

8. A communication system, comprising:

a processor; and

a memory, wherein the memory stores computer executable instructions that when executed by the processor, cause the processor to perform a method comprising:

receiving wireless access for a communication session over a Code Division Multiple Access (CDMA) wireless communication network;

receiving a registration request transferred by a user device for wireless access from another wireless communication network, different from the CDMA wireless communication network;

receiving authentication information for the communication session from Authentication, Authorization, and Accounting (AAA) equipment in the CDMA wireless communication network over the CDMA wireless communication network; wherein the authentication information comprises at least one of user device authentication information, user authentication information, or network authentication information; and

in response to the registration request, processing the authentication information for the communication session over the CDMA wireless communication network to selectively bypass an associated authentication process in the other wireless communication network to authenticate the communication session in the other wireless communication network, wherein the other wireless communication network comprises one of: a Long Term Evolution (LTE) wireless communication network or a Worldwide Interoperability for Microwave Access (WiMAX) wireless communication network;

processing an activity level of AAA equipment in the other wireless communication network to select the associated authentication process in the other wireless communication network to bypass, wherein the activity level of the AAA equipment in the other network comprises at least one of a registration drop rate, a registration incomplete rate, and a processor utilization level.

9. A method of operating a communication system, the method comprising:

exchanging communications with a user device for a communication session over a CDMA wireless communication network using a CDMA wireless communication mode;

receiving a handover request transferred by the user device for transition of the communication session from the CDMA wireless communication network to another wireless communication network;

in response to the handover request, receiving authentication information for the communication session over the CDMA wireless communication network from Authentication, Authorization, and Accounting (AAA) equipment in the CDMA wireless communication network; wherein the authentication information comprises at least one of user device authentication information, user authentication information, or network authentication information;

processing at least a first portion of the authentication information for the communication session over the CDMA wireless communication network to selectively bypass an associated authentication process in the other wireless communication network to authenticate the communication session in the other wireless communication network, wherein the other wireless communication network comprises one of: a Long Term Evolution (LTE) wireless communication network or a Worldwide Interoperability for Microwave Access (WiMAX) wireless communication network;

processing an activity level of AAA equipment in the other wireless communication network to select the associated authentication process in the other wireless communication network to bypass, wherein the activity level of the AAA equipment in the other wireless network comprises at least one of a registration drop rate, a registration incomplete rate, and a processor utilization level;

and

exchanging further communications with the user device for the communication session over the other wireless communication network using another wireless communication mode.

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